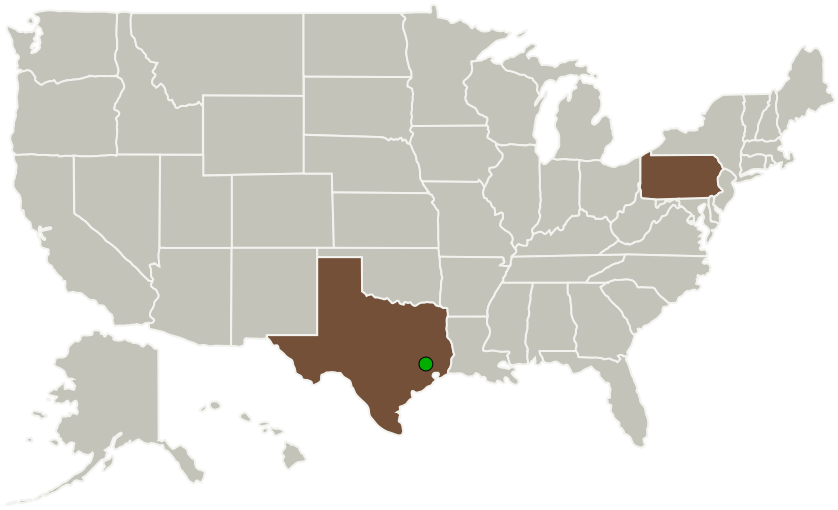
Retractable Robotic Anchor for Hard Rock and Granular Soils, Phase I

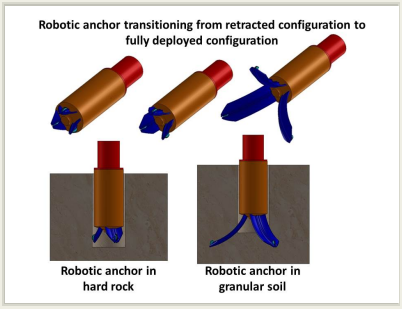
Completed Technology Project (2016 - 2016)

Project Introduction

ProtoInnovations proposes to research, develop, and validate an innovative retractable robotic anchoring mechanism that works both in hard rock and granular soils permitting anchoring and subsequent repositioning of a lander, rover or other equipment. Our goal is to support a number of mission targets to Mars, the Moon, and asteroids. The technology proposed here is of special value to planetary missions involving extreme terrain mobility, small body/microgravity mobility, and missions that involve forceful interaction with the environment (e.g. drilling, digging, etc.) These missions are all ranked as High Priorities in NASA's Robotics, Tele-robotics, and Autonomous Systems Roadmap Technology Area 04 (April 2012). The use of retractable anchors could also benefit missions involving multi-rover exploration, instrument employment, infrastructure emplacement, etc. In Phase 1 we will: 1- Research the mechanics of robotic anchoring in hard rock and soft soils; 2- Design and prototype a working robotic anchoring mechanism; 3- Conduct proof-of-concept and performance characterization testing; 4- Demonstrate the weight holding capacity of the prototype anchoring mechanism on a vertical and inverted surface.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Protoinnovations, LLC	Lead Organization	Industry	Pittsburgh, Pennsylvania
Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations	
Pennsylvania	Texas

Project Transitions

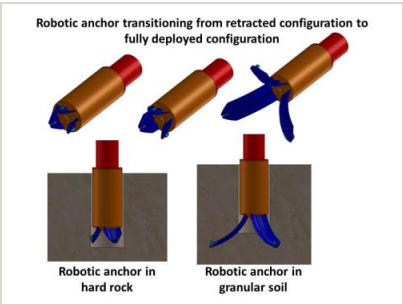
June 2016: Project Start

December 2016: Closed out

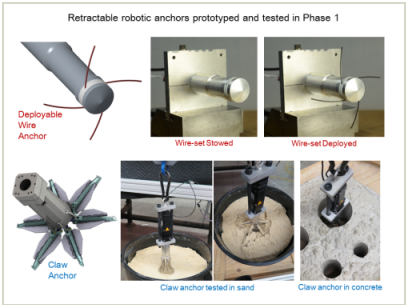
Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139686)*

Images



Briefing Chart Image
Retractable Robotic Anchor for Hard Rock and Granular Soils, Phase I *(https://techport.nasa.gov/image/131659)*



Final Summary Chart Image
Retractable Robotic Anchor for Hard Rock and Granular Soils, Phase I Project Image *(https://techport.nasa.gov/image/134216)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Protoinnovations, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

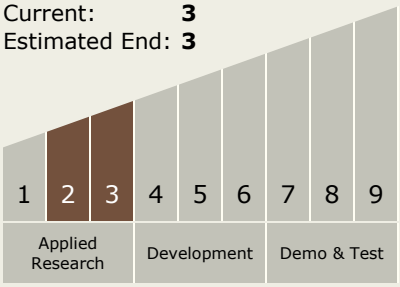
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Dimitrios Apostolopoulos

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.1 Dexterous Manipulation

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System